3D PRINTED MODELS FOR PREOPERATIVE REHEARSAL TO IMPROVE OPERATIVE OUTCOMES PRIOR TO COMPLICATED AORTIC SURGERY

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DISCLOSURES

• NO RELEVANT DISCLOSURES

• ... BUT I AM OPEN TO OFFERS
STANDARD EVAR IS NOW FIRST-LINE FOR AAA REPAIR – BUT INCREASINGLY COMPLEX!

• Despite clearly defined manufacturers’ instructions for use (IFU) clinicians regularly use EVAR grafts outside of anatomical criteria
• There is always a desire to “stretch the indication”
• There is a widening pool of “complex AAA” requiring treatment: juxtarenal, suprarenal, thoracoabdominal, aortoiliac, revision surgery
• Preoperative simulation and rehearsal can reduce procedure time and improve success
3D PRINTING CAN PROVIDE COMPLEX AAA MODELS

- High-resolution CTA -> Software 3d Models
  - OsiriX MD ($500), 3dSlicer (Open Source)
- 3d shell created, 3d printed and assembled
  - FormLabs Form 2 SLA 3d Printer ($5000)
  - Clear Photopolymer Resin ($300)
- Coated in lacquer to improve transparency
- Fixed to benchtop for direct vision access and fluoroscopic imaging
- Trial cannulation of vessels by expert and non-expert surgeons and surgical trainees blinded to surgical procedure

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POSITIVE RESULTS & BENEFITS

• Sample patient: 4-vessel Chimney EVAR
• Successful prediction of cannulation challenges
  • Failed negotiation of 18F sheath via right axillary artery
  • Failed introduction of two simultaneous 7F sheathes via right axillary artery
  • Unstable positioning of left renal artery Viabahn® stent due to early left renal bifurcation

• Improved anticipation of required equipment and catheters with expected reduction in wastage
• Excellent fluoroscopic visibility (ultimately)

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NEGATIVE RESULTS & CHALLENGES

• 3D Print and assembly of an entire aortic tree is time-consuming
  • Print time 40 hours
  • Assembly >25 person-hours
• Fragile model, limited material characteristics limit simulation
  • Rigidity, Deformation
  • Compliance, Lubricity
• Challenging to produce pressurised flow model (Work in Progress)
CONCLUSIONS

• Low-cost materials, software and hardware can produce an effective, 3d printed vascular tree for training and preoperative simulation.

• In house production is currently time-consuming but will improve

• Equipment, materials, experience and technique will improve model fidelity
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Use Of 3d Printed Models For Pre Operative Rehearsal Prior To Complicated Aortic Surgery

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